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RESEARCH REPORT

TACTICAL RECONNAISSANCE: OPPORTUNITIES THROUGH INTEGRATION

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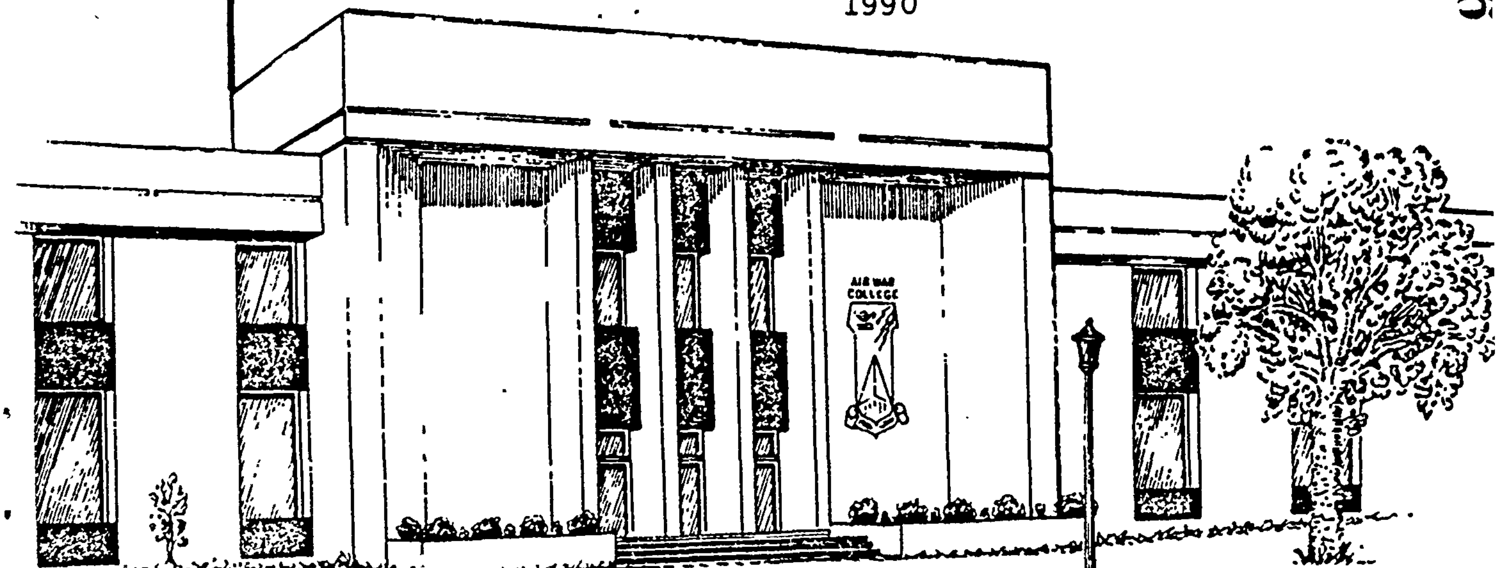

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TACTICAL RECONNAISSANCE: OPPORTUNITIES THROUGH INTEGRATION

by

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EXECUTIVE SUMMARY

TITLE: Tactical Reconnaissance: Opportunities Through Integration AUTHOR: Richard L'Heureux, Colonel, USAF

US tactical reconnaissance is currently a hodgepodge of "stove-pipe" systems unable to meet the requirements of modern high-intensity warfare. We find ourselves in this situation largely as a result of uncommitted leadership, budget constraints, mission rivalries, and uncoordinated development and acquisition.

Three very ambitious tactical reconnaissance programs are under development which should significantly improve our capability to provide intelligence and surveillance information to tactical commanders. These are the Follow-On Tactical Reconnaissance System (FOTRS), the Tactical Reconnaissance System (TRS), and the Joint Surveillance Target Attack Radar System (Joint STARS). Their integration as a complementary, interoperable reconnaissance team would add to their overall capabilities, improve their flexibility and survivability and enhance the quality of the resulting intelligence and targeting information. Yet as with others in the past, these systems have for the most part been developed with little consideration for how they might be integrated as a team.

An examination of the three common categories of components--sensors, data links and ground processors--suggests areas where interoperability might be

most easily achieved. As a start we should look at modifications in these components to interconnect Joint STARS and the TRS and permit the FOTRS ground processor to accept TRS radar imagery. These two areas alone would significantly improve the quality of information afforded the supported commanders and untether the TRS system for world-wide operations. But other measures, like the development of common inter-site communications, would also have significant payoff.

Certainly DoD and the services have given lip service to the advantages of commonality and interoperability among defense programs. Program directors, however, are easily distracted when pursuing program specific objectives. Strong and consistant direction is needed at DoD level to ensure the services stay the course on interoperability and take full advantage of the improvements to be gained in tactical reconnaissance.

BIOGRAPHICAL SKETCH

Colonel Richard J. L'Heureux (MA, Monterey Institute of International Studies) is a career intelligence officer and Joint Specialty Officer whose first involvement with reconnaissance operations began when he was assigned to an RC-130 operation in 1969. Since that time he has been associated with RC-130, RC-135, U-2R and TR-1 intelligence collection in both the Pacific and European theaters. In addition to his time spent in the collection side of intelligence, he has held various analytical and supervisory posts including some seven years in Washington D.C. His most recent position was as Director of Intelligence Plans and Systems, Headquarters United States Air Forces in Europe. Col L'Heureux is a 1980 graduate of Armed Forces Staff College. He is also a graduate of Air War College, class of 1990.

ACKNOWLEDGMENTS

The author wishes to thank two resident students at Air University for providing technical guidance in the production of this paper. Lt Col Mike Prowse (Air War College) was a program manager in AFSC assigned both to the Joint STARS and the JSIPS program offices and was a leader in integration initiatives for each. He also served as the Chairman of the Special Working Group on Stand-off Surveillance and Target Acquisition Systems (SOSTAS), NATO Air Force Advisory Group, Air Group 4. His assistance was invaluable, especially in simplifying the complexities of Joint STARS, JSIPS and NATO SOSTAS activities. Maj Doug Neuberger (Air Command and Staff College), a former RF-4C Weapon Systems Officer, was most recently in charge of advanced reconnaissance plans and programs within the DCS for Technology and Requirements Planning, Hq AFSC. His description of current efforts to work the integration problem was extremely helpful in identifying possibilities for the future.

CHAPTER I

INTRODUCTION

Over the ages commanders have grappled with the need to see their enemy beyond the horizon. Sun Tzu wrote 2300 years ago "it is foreknowledge that enables . . . an excellent leader to triumph over others wherever they move".[1] Military tacticians continually sought ways to improve their ability to see their enemy. When French republican forces first used a tethered balloon at the Battle of Fleurus on 26 June 1794 for battlefield observation they opened new opportunities for reconnoitering the enemy.[2] The lesson of airborne reconnaissance was not lost on the US military. The initial and principal use of our fledgling army aviation in the Mexican Campaign in 1916 and again n World War I was reconnaissance. While our capability was quite primitive, from the first days of US military aviation the US has had a relatively firm commitment to observing enemy activity from airborne platforms.

The history of airborne reconnaissance has been marked by uncoordinated technical development, uneven support leading to disparate and often competing programs, and an inability to keep pace with requirements and the threat. Our current Air Force tactical reconnaissance capability is somewhat of a hodgepodge of systems poorly matched to the needs of mid- to high-intensity conflict as expressed in AirLand Battle and its NATO corollary follow-on forces attack (FOFA). It is also only marginally suited to low-intensity operations in far-flung areas offering limited basing support and requiring maximum flexibility. While the USAF may appear to have the numbers and variety necessary to meet its mission, closer examination reveals the systems are not sufficiently integrated, rely on oftentimes fragile communications and are in general unsuitable for timely dissemination of critical information to the large numbers of potential users in varying worldwide scenarios. As one critic writes, present systems "fall short in providing broad, deep, continuous coverage and targeting data on highly mobile systems . . . ;"[3] while another complains they are ". . . adequate in peacetime but lack the redundancy and distributed collection and processing capability necessary to sustain war operations."[4]

Numerous airborne reconnaissance systems now under development in the USAF to provide commanders with tactical intelligence offer hope of redressing these problems. Soviet military strategists note the potential of these systems, especially their capability when linked to smart munitions to guide delivery of unprecedented fire on Soviet follow-on forces.[5]

In 1984 then Soviet Chief of General Staff Ogarkov likened the destructiveness of smart munitions linked to sophisticated surveillance and targeting systems to that of nuclear weapons.[6] The Soviets assume our plans for developing these "reconnaissance strike complexes" have or will become a reality, encouraging them to reassess their ability to fight a conventional war in central Europe.

But even these new systems have limitations which can significantly impact their relevance to the battlefield. A coordinated effort to ensure these systems interoperate and are mutually supportive will greatly improve their contribution to the warfighter. The USAF's future challenge will be to develop a reconnaissance strategy for the 1990s and beyond which will integrate these systems together in a way that ensures maximum effectiveness, supportability and survivability across the spectrum of conflict--a system that can make Marshal Ogarkov's worst fears come true. How did we come to this collection of disparate and unmatched systems? What do we have in the inventory or in the pipeline today to improve on? What can we do to make sure we maximize the usefulness and survivability of these systems? Before I begin to tackle these questions, let me first explain what I mean by tactical intelligence and what types of systems will be included in this discussion.

The Focus

My concern in this paper is with the capability, the weaknesses and ultimately the potential improvements in airborne imagery collection programs to provide tactical intelligence to a supported commander. By tactical intelligence I mean the "intelligence which is required for the planning and conduct of tactical operations . . ." within a military commander's scheme of maneuver.[7] While tactical may suggest something more limited, in fact this intelligence supports echelons from the theater Commander-in-Chief on down. Very often this intelligence is of different detail and type than strategic intelligence, but clearly capabilities are improving to such an extent that developing systems will support tactical, operational and even strategic levels of command.

Of course numerous systems can provide tactical intelligence information to the commander. Tactical Air Command (TAC) maintains that any reconnaissance information which is of interest to a tactical commander is tactical reconnaissance.[8]

With such a broad interpretation of what tactical reconnaissance is we can easily imagine a tactical reconnaissance architecture networking inputs from a large assortment of systems to include satellites, ground and shipborne collection sites, national airborne systems, as well as tactical airborne imagery systems. While a study of such magnitude would doubtless benefit those considering broad intelligence architectures, my intent here is to focus on the USAF's tactical airborne collection systems, i.e. those airborne systems like the TR-1 and RF-4 which fall under the operational control of theater commanders or their subordinates, and as such are generally more responsive to the needs of the tactical commanders.

In discussing these systems there is sometimes confusion over the roles of reconnaissance and surveillance and what constitutes a reconnaissance and surveillance platform. The distinction between the two is subtle. According to TAC Manual 2-1, reconnaissance employs a more <u>active</u> collection method, while surveillance provides information from more systematic and <u>passive</u> observation, especially of broad areas.[9]

The differences are of modest importance and are becoming more obscure each day. As we develop multisensor collection platforms capable of in-flight retasking, reconnaissance and surveillance can be performed at the same time on the same platform. For purposes of this discussion reconnaissance and surveillance are similar complementary activities performed by tactical airborne collection systems to provide commanders timely, high-quality information to prepare for and conduct combat operations. Both reconnaissance and surveillance functions should be immutably integrated into the tactical airborne collection network developed for US and allied forces.

CHAPTER II

THE RECONNAISSANCE MISMATCH

Airborne reconnaissance has had a long history in the US military, but uneven development has left tactical reconnaissance essentially broken. Current fielded systems are limited in numbers available to meet OPLAN requirements, in sensor ability especially where night/poor weather performance is required, and in the speed with which information can be processed and reported. One critic recently complained that despite attempts to improve tactical reconnaissance, it is ". . . still not as responsive to user requirements as it needs to be . . . ," claiming that ". . . its most obvious shortcoming is its inability to provide the battlefield commander with near- or real-time intelligence."[1] Echoing this sentiment, Lt Gen Calvin A. H. Walier, Commander of the U.S. Army's I-Corps, complained to a group of senior Air Force officers of getting reconnaissance information too late to do any good, and requesting a down link direct to the Corps' intelligence center.[2] If we are to redress this apparent mismatch between US reconnaissance capability and the requirements of our battlefield commanders for intelligence, we should know something about how this discrepancy between capability and requirements evolved.

This mismatch resulted from a number of factors which encouraged separate, often divergent, development and the pursuit of parochial interests. Not surprisingly, some of these factors will be familiar to even casual observers of defense development and acquisition.

Leadership Advocacy

Since early military aviators first discovered the dramatic capabilities of aircraft to deliver bullets and bombs on the enemy, advocacy for reconnaissance has waxed and waned. Reconnaissance has been a key mission element from the aircraft's earliest days, but few senior advocates have fallen on their swords to ensure the durability and appropriateness of USAF tactical reconnaissance assets.[3] It is remarkable the main auditorium at the Squadron Officers School at Maxwell AFB is named after Col Karl Polifka, a pioneer of tactical reconnaissance in the USAF. Were it not for that, few Air Force officers would be exposed to any key reconnaissance figures in the USAF.

Budget Constraints

Lack of sustained high-level advocacy impacted especially on the tactical reconnaissance community's ability to withstand numerous budget perturbations over the years. Time and again a viable reconnaissance acquisition strategy was developed only to succumb to greater needs dictated from above. In peacetime especially, tactical reconnaissance suffered the disadvantages of low priority.[4]

The USAF has found itself modifying or building what was affordable at the time within a given budget line rather than taking the longer view of what is right for the joint military community. A telling example occurred in the 1950s and early 1960s when, despite exhaustive review of the reconnaissance shortfalls of the Korean War, tactical forces (including reconnaissance forces) took backseat to the budget-induced strategy of "massive retaliation." Strategic forces got the attention while general purpose forces languished.[5] Reconnaissance problems noted in the Cuban missile crisis, as well as a shift in national strategy to "flexible response," freed money for the RF-4 program.[6] But even with that leap in capability, we did not procure a system equal to the massive requirements of the Vietnam War.[7] In recent years TAC developed a "Tactical Reconnaissance Roadmap", but when doing so was still uncertain whether a new manned tactical reconnaissance platform would be funded to replace the many RF-4s retired due to fiscal pressures.

Service and Mission Rivalry

The mismatch is in part a result of different service and mission approaches to tactical reconnaissance. With the creation of the USAF in 1947, the tendency for air and ground commanders to look at requirements for intelligence support somewhat differently was magnified. In the USAF's early days, reconnaissance units were to serve multiple communities both inside and outside the Air Force, sometimes providing strategic and sometimes tactical information. The reduction in units after World War II and Korea aggravated these problems and encouraged a tendency in USAF units to support air commanders over ground commanders.[8] At one point reconnaissance aircraft were performing secondary missions in USAFE and PACAF standing alert as nuclear strike aircraft. According to one reconnaissance expert "the Air Force was required to think in terms of worldwide intelligence rather than battlefield surveillance. This in essence degraded the needs of the ground commanders and relegated their reconnaissance priority to a lower level. The result was a doctrinal dispute between the two services . . . ."[9]

Of course the Army, desiring more direct control over reconnaissance assets, had reason to accentuate the shortfalls noted in wartime operations. It no doubt recognized USAF advocacy and dollars would never be sufficient to field enough systems to provide its divisions and corps information sufficiently tailored to their needs. Accordingly, it pursued a number of tactical reconnaissance systems of its own.

The Navy developed its own tactical reconnaissance capability tailored to the mobility requirements of the fleet. At first paralleling the Air Force by fielding reconnaissance versions of frontline fighters like the RA-5C and the RF-8G, in 1981 it developed the Tactical Air Reconnaissance Pod System (TARPS) to enable its F-14s to carry out a secondary mission of tactical reconnaissance and save space on the carriers.[10]

Perturbations in tactical reconnaissance development were accentuated by the various missions of Air Force major commands (MAJCOMs). Despite TAC's attempt to provide central direction for the Tactical Air Forces (TAF), differences in command missions from TAC, to USAFE to PACAF are significant enough to encourage the MAJCOMs to force command unique adjustments to major Air Force programs or to develop programs of their own. Clearly each command must adjust its approach to the requirements of its environment. In Europe, USAFE provides tactical intelligence to support a multitude of US and non-US commanders fighting a dense ground and air threat in a relatively confined area. In the Pacific, PACAF must plan for war over a broad area, providing information to mostly US forces and against a maritime threat as well. TAC must be able to fight in both environments, while preparing for contingencies elsewhere. Each orientation can effect the preferred platform, sensor, processing and communications for the using command.

Congress has on occasion complicated matters by exploiting inter- and intra-service differences to delay or cancel reconnaissance upgrades. Congressional opposition in the 1970s and 1980s to RF-4 upgrades, including the Advanced

Tactical Air Reconnaissance System program, was not only a result of skepticism about the survivability of manned penetrating reconnaissance, but also a concern about the lack of agreement in the TAF on how to proceed with the upgrade.[11]

Strategic Versus Tactical Mission

Air Force planners have been required to also identify resources for both strategic and tactical collection requirements. Rightly or wrongly, the attention and the money have gone to the strategic systems.[12] This should come as no surprise in view of the favor granted strategic forces in the early days of the Air Force and the glamor and notoriety associated with "black" reconnaissance programs like those emanating from Lockheed's famous "Skunk Works".

Tactical commanders have suffered doubly from this trend. Not until the past decade have strategic systems been used in any systematic way to respond to the information requirements of the tactical commanders. In part due to Congressional encouragement, the armed services are now devoting considerable effort to a program for more efficient use of strategic reconnaissance. This program, called Tactical Exploitation of National Capabilities or TENCAP, is helping redress tactical reconnaissance shortfalls. However, even at its best, TENCAP cannot substitute for a robust tactical reconnaissance force.

"Black" Reconnaissance Developments

"Black" or clandestine reconnaissance programs scored remarkable successes in the reconnaissance field. However, the compartmented nature of "black" world development and acquisition have worked against integrating such programs with other reconnaissance and command and control systems. Thus they have contributed to uneven development of our reconnaissance capabilities. In an effort to reduce exposure of "black" programs, information on breakthroughs in such things as sensors and data links may not be readily available to conventional programs. As a result, they contribute to duplication of effort, incompatible systems and ultimately non-satisfaction of information requirements.

Having suffered a somewhat disjointed evolution in reconnaissance over the past 70 years where does the USAF find itself now? What systems do we have available to do the tactical reconnaissance mission?

CHAPTER III

CURRENT PROGRAMS

A look at the current state of tactical reconnaissance in the USAF reveals both good and bad news. As for the bad news, the USAF's capability to conduct tactical reconnaissance against a major foe like the USSR or North Korea is rather constrained, relying too heavily on an aging and declining fleet of RF-4s. Budget pressures have resulted in reductions of active and reserve RF-4 squadrons from 22 in 1974, to 13 in 1984, and to 9 in 1989. That number may be further reduced by two or three squadrons given the proposed 1991 DoD budget. Of the current nine squadrons, four are in the active force, with five (a sixth is currently forming) in the National Guard. In fact there are only about 180 RF-4s left, all built before 1974.[1] The good news is there are three very substantial reconnaissance and surveillance programs currently underway and within funding. Each of these will have a dramatic impact on the way USAF meets its mission requirements in the future.

Follow-On Tactical Reconnaissance System

FOTRS is a long awaited and ambitious joint program intended to breath life into penetrating tactical reconnaissance. Its origins lie with the Advanced Tactical Reconnaissance System (ATARS), a program first envisioned in a TAC Statement of Need (SON) in 1979. The SON called for a replacement for the RF-4 which would use electro-optical (EO) rather than conventional film-based imagery systems.[2] The program has since been expanded to include both penetrating manned and unmanned platforms for under-the-weather, day/night collection as well as ground exploitation stations to provide near-real-time (NRT) imagery intelligence to tactical commanders.[3] Accordingly, the program involves two major related projects: the Tactical Air Reconnaissance System (TARS) and the Joint Service Imagery Processing System (JSIPS).

<u>TARS</u>. Under the TARS program, the USAF is program manager for development of a common suite of EO and infrared sensors to be integrated into Marine Corps F/A-18Ds, Navy F-14D TARPS and pods to be carried by RF-X, a follow-on in-production USAF tactical reconnaissance aircraft. In addition, the sensors, along with a weather sensor (for pre-strike weather reconnaissance), are to be integrated into a common suite of short, mid-range and extended-range Unmanned Aerial Vehicles (UAV) which are under development by a Navy-led Joint Program Office. While TARS is designed to meet some of the needs of all the services, TAC envisions using a mix of TARS-equipped RF-Xs (probably the RF-16) as well as TARS-equipped mid-range UAVs to meet USAF's requirements for highly mobile and flexible penetrating reconnaissance. The manned platform will be capable of

penetrating about 300 NMs on missions where in-flight flexibility, like searching out mobile targets, is most required. A ground-launched UAV will be used especially in high threat areas and against fixed targets penetrating up to 200 NMs. An air-launched UAV will give even better penetration distances. Initial operational capability (IOC) for the EO sensors is expected in the mid-1990s.[4]

TARS will provide significant timeliness advantages over current film-based operations. The system will use EO sensors, an infrared linescanner, digital recorders, and data links. The sensors, using charge-coupled devices in focal plane arrays, record data on digital tape. The data can be reviewed and edited by the crewmember. All or part can be downlinked in a high speed "data dump" when in line-of-sight of the ground processor, or removed when the platform lands. Real-time downlinking is possible if the platform is within line-of-sight of both ground site and target area. It takes a few hours to report information from film-based systems. With TARS that time can be reduced to about 15 minutes. As a digital electronic product, the image itself can be forwarded virtually anywhere secure communications circuitry permits.

JSIPS. While TARS will develop both the sensors and the airborne portion of the data link of FOTRS, JSIPS will concentrate on the ground exploitation segment of the system. USAF as lead agency for JSIPS and working jointly with the Army and Marine Corps will develop common mobile ground processing stations. These will receive, process, exploit and disseminate intelligence reports and imagery products from not only the TARS-equipped platforms but from national platforms as well.[5] Though its primary sensor input will be EO, it will process infrared (IR) and radar imagery as well. It will also be able to digitize and exploit conventional film-based products.

Because the system is electronic, permitting computer or "soft-copy" exploitation of imagery, JSIPS stations will not have the massive water and chemical requirements, nor the manpower requirements of the current film-based systems. Moreover, its configuration of 3 to 6 computer-equipped mobile shelters can be more easily transported and camouflaged than the 28 shelters of today's reconnaissance squadron.[6]

FOTRS represents a serious effort on the part of the Office of the Secretary of Defense (OSD) and the services to meet multiple US tactical reconnaissance requirements by insisting on a modular structure and standardization of sensors, data formats, recording media and data links. It is also establishing a firm base for expansion and integration with non-US programs and with other technologies. It is doing so through a number of efforts.

First, other NATO air forces have recognized the advantages of EO systems and soft-copy exploitation and are pursuing programs of their own. NATO's Air Group 4, charged with identifying NATO interoperability issues, is currently working with member countries to develop reconnaissance standards for future EO systems. On behalf of the USAF and Air Group 4, the FOTRS program hired a contractor team to explore ways to standardize EO reconnaissance systems. The team recommended deployment of an "image reformation system" at JSIPS and British ground stations to convert tapes from various reconnaissance aircraft into an exploitable format.[7] Using "reformatters" to translate data from one format to another is a compromise solution. The preferred option is to develop common standards for data links and recorders among all the allied partners, and impose them on systems before they are fielded.[8]

Second, the FOTRS developer--Air Force Systems Command (AFSC)--has been charged to "program for a processing capability for other tactical and theater sensors" as an eventual product improvement.[9] AFSC plans to develop an imagery data reformatter system that will permit JSIPS not only to process the EO and IR data from TARS, but to handle IR, EO, Advanced Synthetic Aperture Radar-2 and Synthetic Aperture Radar (SAR) imagery from other platforms as well. AFSC is essentially looking for an all-in-one ground processor which would allow JSIPS to exploit any number of imagery-type products.[10]

Finally, the USAF is looking at possible sales of TARS upgrades to countries now operating RF-4s, especially West Germany, but also Turkey, Japan and South Korea. For those allies operating F-16s, the USAF is exploring the possibility of developing a multinational TARS pod for their use.[11]

The FOTRS program has established an excellent base for the kind of broad integration needed in the tactical reconnaissance community. As we shall see, more can be done.

Tactical Reconnaissance System (TRS)

In the late 1970s the USAF recognized the need for a balanced approach to tactical reconnaissance between standoff systems, like the emerging TR-1, the tactical derivative of the venerable U-2R, and the fleet of RF-4 manned penetrators.[12] Following soon after, and in concert with a quickly evolving FOFA doctrine, NATO leaders recognized the need for a robust network of standoff reconnaissance and surveillance systems which would provide the benefits of poor weather, day/night coverage, peacetime application, frequent revisit, broad area coverage and NRT reporting.[13] Both the TRS and Joint STARS programs were in part developed to meet US and NATO requirements.

USAF, in close cooperation with the Army, initiated the TRS program to mount a Hughes Aircraft-developed Advanced Synthetic Aperture Radar (ASARS) -2 on the TR-1 airframe and build associated data links and ground stations. Mounted in the nose of the aircraft, ASARS-2 digitally formats radar images and sends them via data link to the ground where imagery interpreters monitor target activity up to more than 100 NMs from the aircraft's track. At standoff ranges of 30 NMs or so from the forward line of own troops (FLOT), operators can view first echelon armies in real-time on a broad front and report events to supported commanders within about 15 minutes.[14] As a radar-based system, it produces images at day or night, even in bad weather. ASARS-2 is optimized for observing fixed targets in either search (lower resolution) or spot (higher resolution) modes, but Hughes is exploring ways to enhance the radar's capability to detect moving targets.[15]

TRS is especially valuable because it incorporates not only ASARS-2, but the electronic sensors formerly available on the U-2R and TR-1. This multi-sensor capability gives the system robustness and flexibility not available with other collection systems, and as a result significantly enhances the quality of the intelligence produced.

USAF is developing TRS for the European theater, but as with the U-2R it has application throughout the world. A prototype system called the Tactical Reconnaissance

Exploitation Demonstration System (TREDS) is currently operational in West Germany and validating concepts and design for the follow-on hardened TR-1 Ground Station or TRIGS.[16] The 17th Reconnaissance Wing at RAF Alconbury was established to support TREDS and eventually the TRIGS operations. After receiving its first TR-1 in February 1983, the wing has been building up to its full complement of approximately 20 aircraft.[17]

TRS offers tremendous capabilities, but suffers weaknesses in survivability and mobility. Though the TR-1 is a high flying aircraft, it is still relatively slow and vulnerable to modern Soviet weapons like the SA-5 surface to air missile and the FLANKER fighter. During hostilities, until these threats are neutralized, the TR-1 will be forced to modify its operations, primarily by standing further back from the battle area. As a result it will give up much of its target coverage.

Because the system is tethered by data link to a ground station, it is restricted to flight operations within line-of-sight of the station. The Air Force has chosen to build hardened underground facilities to support exploitation and reporting of combined ASARS-2 and other sensor information. While these provide considerable hardness and excellent support, they present a lucrative target for an enemy and are the Achilles' heal of the system.

The Army is developing a mobile van-mounted system called TRAC (Tactical Radar ASARS Correlator) which will be connected to their version of JSIPS called the Imagery Processing and Dissemination System (IPDS). IPDS, along with TRAC, will be assigned to the corps-level Combat Electronic Warfare Intelligence (CEWI) Brigade. In essence, TRAC will act as a kind of reformatter, or front-end device to add to the Army corps' JSIPS (i.e. IPDS) configuration, and permit JSIPS to exploit the ASARS-2 imagery. Since it is capable of both exploiting ASARS-2 imagery and managing the TR-1 imagery collection mission, TRAC will be an important backup should USAF's TR-1 ground station be lost.

The 1981 System Operational Concept for TR-1 called for the system "to interoperate with joint US and allied collection systems as well as command and control."[18] Much has been done to ensure communications and functional interfaces with US and NATO forces and interoperability with TRAC. But until recently, very little was done to integrate the ASARS-2 collection component with other imagery collection operations.

<u>Joint Surveillance and Target Attack Radar System (Joint STARS)</u>

The third and certainly most ambitious system is Joint STARS. USAF is the executive service in this joint Army/Air Force program to build "a common, interoperable radar system for joint use in the air/land battle."[19] Joint STARS is an outgrowth of the DARPA-sponsored ASSAULT BREAKER program dating from the mid-1970s. ASSAULT BREAKER was established to demonstrate technologies available to detect, locate and track massive mobile armor formations like that to be encountered in Europe's central region. PAVE MOVER, the Air Force's portion of the program, concluded its testing of prototype radars aboard a modified F-111 and F-4 aircraft in 1983, demonstrating its ability to handle all required functions. An Army-developed heliborne radar system called SOTAS (Standoff Target Acquisition System) was also being demonstrated. While two prototypes of this radar were produced, the program was terminated in 1981 in favor of Joint STARS. As part of SOTAS the Army produced a ground processing system for radar exploitation called a Ground Station Module (GSM). Under an agreement between the Air Force and Army Chiefs of Staff the Air Force was designated to develop the airborne system of Joint STARS using PAVE MOVER technology, while the Army developed the ground system based on its GSM.

Joint STARS employs an X-band pulse doppler radar with a large agile beam antenna to be faired under the belly of refurbished 707-320 airframes. A force of some 22 aircraft, to be designated the E-8B, is currently programmed. A series of test flights aboard a modified 707-320 began in December, 1988 with a second aircraft entering testing in late 1989. Demonstration flights are scheduled for Europe in mid-1990. A production decision is expected in late 1991, with the first production aircraft rolling off the line in 1994.[20]

Flying over friendly territory, Joint STARS will provide day/night, all-weather surveillance and targeting information on enemy forces over a broad area to a depth of more than 100 NMs.[21] Several radar modes will be interleaved to ensure satisfaction of requirements levied by both Air Force and Army airborne operators and ground-based users. Perhaps most important will be its capability to work in Dopplen providing moving target indicator (MTI) readings over a broad area. This wide area surveillance mode will permit users to detect, monitor, track and pass targeting information on large-scale troop movements for friendly airborne (AWACS, fighters) and ground-based (artillery, multiple launch rocket system, army tactical missile system) attack systems. Through its time-sharing capability, the system also permits near-simultaneous operations to focus on smaller areas of special interest for more frequent and precise coverage. Because of this capability some liken Joint STARS to an AWACS for ground commanders.

Along with the MTI capability, the radar can operate in a synthetic aperture radar mode to give fixed target indicator (FTI) readings. This can be used to confirm the location of targets that have stopped moving. In this way Joint STARS can replicate the capability of ASARS-2 but with less of a capability to identify individual targets.

The E-8B will be connected to various Army and USAF command, control and intelligence elements via two different jam-resistant digital data links. Army GSMs will be connected via the Surveillance and Control Data Link (SCDL), which will relay information requests to the aircraft and specific track plotting data (to include raw returns as well as processed data) to the ground. The USAF is considering using both SCDL and the Joint Tactical Information Distribution System (JTIDS). The SCDL will provide detailed tracking data to select intelligence facilities for fusion with other intelligence and surveillance information, while JTIDS would relay summary type information for operational forces.

While envisioned to support NATO's FOFA concept, Joint STARS was always intended as a mobile system with worldwide application. As with JSIPS and TRAC, the ground exploitation segment--the GSM--will be mobile. The Army plans to procure approximately 100 GSMs thus adding to theater redundancy and survivability. These will be S-280 shelters-mounted on five-ton trucks and deployed down to division level, and in the case of some fire support units to battalion level. The Air Force does not envision procuring many, if any, GSMs. It intends instead to interface Joint STARS with existing C3I capabilities, possibly using GSM-produced modules.[22]

As with the other systems, Joint STARS suffers some inherent weaknesses. Like the TR-1, the E-8B will be vulnerable to both ground-based and airborne threats. USAF is convinced, however, with a combination of standoff operations, an on-board self defense suite, and integration with air defense forces charged with defending high value assets, the system can operate successfully.[23]

In addition, with sensor resolutions inferior to those of TARS and ASARS-2, Joint STARS suffers from an inability to clearly identify targets. Currently the radar is capable of distinguishing between moving tracked and wheeled vehicles. While this is a remarkable accomplishment, in a battle area where thousands of vehicles are likely to be on the move, and in view of the limited number of friendly weapons available for deep attack, a commander will want more precise information so he can be selective about which movers he targets. As an example, his first priority might be to kill a Soviet operational maneuver group spearheaded by T-80 tanks and ready to exploit a breakthrough into his corps area, rather than a non-Soviet T-72 unit preparing to secure a flank. An integration of our tactical assets can enhance Joint STARS' capability to give the commander that detailed information.

Other Systems

While this study features FOTRS, TRS and Joint STARS as major systems for integration, other systems have been in development over the past few years, especially in NATO countries, which offer significant potential for connectivity with the US systems. We do not have the space here to provide an exhaustive list of these; let us discuss a few as examples of what is available for consideration.

Like the US, West European countries have realized the need for maintaining their penetrating tactical reconnaissance assets, but upgraded with EO/infrared sensors built for instant replay and softcopy exploitation. The French and the West Germans are developing EO options for their tactical reconnaissance fleets, and the British have actually begun fielding a system. In 1989 the British began deploying a side-looking infrared system (SLIR) on Royal Air Force Tornado GR-1s, augmenting conventionally-equipped Jaguars stationed in West Germany. The system does not yet have a data link to forward electronically-generated images to the ground for immediate exploitation. However, the Tornado weapon systems officer can review target images on a cockpit display and report via voice to command and control elements.[24] As indicated above, NATO is currently looking into the advisability of developing a reformatter to allow JSIPS to process Tornado tapes. Perhaps more advantageous would be development of a data link common to both the

Tornado and TARS which would permit direct linking to the other's exploitation site.

The Europeans have also recognized the need for more standoff reconnaissance and are pursuing a number of initiatives. To bring some order to this process, NATO organized a working group under Air Group 4 to identify and advocate those Standoff Surveillance and Target Acquisition Systems (SOSTAS) which best contribute to execution of FOFA doctrine. Three systems which appear to have won backing along with TRS and Joint STARS are France's helicopter-borne ORCHIDEE (Observatoire Radar Coherent Heliporte d'Investigation des Elements Ennemis), Britain's ASTOR (Area Standoff Radar) and Italy's SORAO (Sottosistema per la Sorveglianza e Acquisizione Obiettzi). Air Group 4 has established as policy that all NATO SOSTAS systems will be interoperable.[25] Both France and the UK decided early in development to ensure their systems were interoperable with each other and with Joint STARS.

As with Joint STARS, ORCHIDEE will mount an X-band pulse-doppler radar with MTI capability. Information will be relayed via data link to ground stations where it will be processed and forwarded over military communications circuits. The radar will be mounted aboard French Army Super Puma MK. 2 helicopters.

Though not as mature as the US and French standoff systems, the British ASTOR program intends to deploy an airborne radar to handle both the Army's requirements for tracking moving targets and the Royal Air Force's requirements for coverage of static facilities, and disseminate data in real-time to supported commanders.[26]

The Italian system may be the most ambitious of the three. Aeritalia is developing a fully integrated suite of imaging radar-equipped drones and helicopters plus supporting command and control. The SORAO network will provide division-level support.[27]

Clearly we have a number of highly capable albeit separately developed systems in the process of development or deployment. How do we ensure their interoperability and thus their usefulness for the battlefield commander?

CHAPTER IV

INTEGRATION--KEY TO THE FUTURE

As we examine the key programs coming on line we notice a number of weaknesses characteristic of each, but we also note important strengths. I've summarized these at table 1. The central thesis of this paper is that to maximize our reconaissance capability, we need to use the strengths of one system to minimize the weaknesses and enhance the strengths of the others. We will achieve this synergism by integrating components whereever practical, in effect making a system of systems in which each--FOTRS, TRS and Joint STARS--share or replicate components, interoperate and thus complement each other's operations to the maximum extent possible. As a practical matter this could mean exploitation personnel at various ground nodes in operations virtually anywhere in the world having the ability in NRT to exploit information derived from the systems' sensors, comparing and fusing this information as necessary and acting as backup exploitation, control and dissemination nodes when required. In order to maximize our capability we should also integrate with other US space-based and terrestrial systems as well as those of friendly countries. I am calling for a vigorous application of what some experts previously referred as a "team approach" to reconnaissance.[1] It requires each component to be as intimately and completely tied into the tasking, collection, processing and reporting cycles of the other systems as possible.

SYSTEMS CHARACTERISTICS

	Strengths	Weaknesses
FOTRS	high resolution good penetration tactical flexibility covers deep targets many platforms	limited coverage indirect to shooters
TRS	multiple sensors good resolution long on station wide area coverage	tethered to ground site few platforms few ground sites airframe survivability indirect to shooters
Joint STARS	moving target coverage multiple ground sites direct to shooters long on station wide area coverage	single sensor limited resolution few platforms airframe survivability

table 1

While it might be hoped program offices can ensure at this late date full and complete integration of components and functions, obstacles like cost and existing technology will no doubt hinder that goal. Even if we can't reach full interoperability among the systems, important benefits can be had by even modest efforts in that direction.

In order to get a better appreciation for how integration can occur, I'll break the programs down into three common component parts, and examine integration from the component point of view. The components are sensors, data links and ground processors. Important progress has already been made in equipment design and standards within these component areas. That progress should point the way to additional improvements.

Sensors

The opportunities for commonality and integration among the various sensors carried by FOTRS, TRS and Joint STARS platforms seem to be fairly minimal. Indeed those factors discussed above causing the "reconnaissance mismatch", where program offices and manufacturers had sought varied technologies to attack slightly different reconnaissance and surveillance problems, have left us with suites of EO, IR, ASARS, SAR and MTI sensors mounted on platforms of very different size and performance characteristics. They are not interchangeable.

The FOTRS program, in its insistance on commonality of sensors for either internal or podded application on RF-X, F/A-18, F-14D and UAVs, is breaking important new ground for interoperability. But even that ambitious program in its attempts to include NATO systems is not looking to replace sometimes indigenously produced sensors with its own. Instead, it wants to standardize data link and recording operations and formats so that an assortment of foreign sensors can produce information which can be exploited at various ground sites.

Modern sensors can convert data into digital information which enables us to interoperate without using like sensor equipment. It also opens the way for broader integration with other digital space-based or terrestrial systems.

Data Links

The proliferation of data links for reconnaissance, command and control, weapons delivery, etc. has been a headache for many in the acquisition and operations communities. There is hope, however, that in tactical reconnaissance standardization will eventually be imposed and integration will result. The data links for FOTRS and TRS are being built by the same manufacturer--Unysis. While these two wideband links are different, many of the subcomponents and characteristics are the same. Steps are being taken to ensure in the future they will remain as common as possible. The system being built for FOTRS, called Miniaturized Interoperable Data Link (MIDL), is an upgraded version of the much larger Interoperable Data Link (IDL) which was built for the TR-1 (and U-2R). According to OSD, the TRS will eventually receive MIDL as a product improvement.[2] Data link compatibility will facilitate modifications to the systems which would permit linking TARS-derived information from USAF, Navy and Marine Corps platforms to the TRS ground site and TR-1 (or U-2R) -derived information to Army and USAF JSIPS locations.

Joint STARS, however, is using two narrowband two-way data links, neither of which is interoperable with MIDL or

IDL. This complicates the interface with FOTRS and TRS. The Joint STARS program manager has been directed to develop a joint USAF and Army plan for "NATO Rationalization, Standardization and Interoperability" and to work with NATO armaments groups on compatibility, to include a common interoperable data link, with systems like ORCHIDEE and ASTOR.[3] But the kind of interoperability envisioned is man-in-the-loop interoperability rather than system-to-system electronic connectivity. The program manager is exploring the feasibility of developing a common data link for the NATO standoff systems which would eventually allow system-to-system connectivity, but he has not been given direction to make Joint STARS interoperable with FOTRS and TRS.[4]

The fact FOTRS and TRS data links will be interoperable was more a result of chance than planning on the part of the USAF. AFSC has taken steps, however, to ensure future data link acquisition is better controlled. A review of what it has done serves as a guide for what might be done with other components as well.

In 1988 TRS developers and the TARS program office were seeking funding for data links for their separate programs. TRS was attempting to reduce the size of its IDL, a development which would make it attractive to the TARS. However, the TARS office was unaware of the IDL improvement, in part because the IDL emerged from "black world" development. More importantly, the TARS program office had assigned selection of its data link to the system prime contractor, and thus had less influence over the selection of the link. Coincidentally, Unisys, manufacturer of the IDL, was selected by the prime contractor to develop the TARS data link.[5]

DATA LINK MATRIX

	Data Links	Type*	Manufacturer
FOTRS	MIDL	Wideband	Unisys
TRS	IDL	Wideband	Unisys
Joint STARS	SCDL JTIDS	Narrowband Narrowband	Cubic Corp. Hazeltine
*Wideband links permit greater data rates and imagery resolution; narrowband are cheaper and omnidirectional.			

table 2

Responding to the general proliferation of data links in the USAF and more specifically to the potential disconnect between the FOTRS and TRS data links, the AFSC Commander, General Randolph, charged his Technology and Requirements Deputate (AFSC/XT) to develop a program to ensure a more rational and efficient way to select data links for USAF programs. Efforts by the Pentagon in the late 1970s to bring order to data link acquisition had not been followed through and AFSC/XT felt a comprehensive attack on the problem was now required. In July, 1989 Gen Randolph endorsed AFSC/XT's recommendations to (1) establish a clearing house at the Electromagnetic Compatibility Analysis Center for information on available data links and on worldwide operating environments, (2) ensure program managers did not develop new systems when an existing system or a modified system would suffice, (3) establish a military standard for the way information is formatted over the data link, and (4) explore ways to ensure a modular approach to data links along the lines of Unisys' MIDL, whereby components would be compatible but system characteristics like frequency, modulation, jam resistance, and power levels could be added or changed on a plug-in basis.[6]

With Unisys now providing MIDL-like data links for TRS, FOTRS and the Navy's BGPHES (Battle Group Passive Horizon Extension System), MIDL has in fact become the standard for future reconnaissance programs.[7] AFSC's efforts were most likely motivated by the need to decrease system development and life cycle costs; they will nonetheless contribute markedly to integration of future systems and the ability to do team reconnaissance.

Ground Processors

Opportunities for interoperability with ground processors seem to be good. As with data links, the FOTRS program has led the way in preparing the JSIPS for eventual cross operation with TRS and Joint STARS as well as with other US and non-US programs. The FOTRS program manager has been directed to eventually improve JSIPS to enable it to process the full assortment of imagery-type data (EO, IR, ASARS, MTI, SAR). Assuming leadership advocacy and resources remain, there appears to be little reason why he cannot succeed in the effort.

Even with FOTRS, however, attaining interoperability hasn't been all that easy. Responding to complaints generated during the Grenada operations, TAC sought to reduce the time it took to exploit imagery from its film-based Long-Range Oblique Photography system (LOROP). TAC asked Air Force Logistics Command (AFLC) to develop an EO sensor and digital recorder for aircraft installation, and exploitation stations for ground use. Imagery was not to be downlinked to the ground. AFLC let a contract for this new system, called EOLOROP, which unfortunately did not specificy use of components common to the FOTRS program. To reduce costs the contractor unfortunately chose not to select the recorder used in TARS. TAC, AFLC and AFSC are now trying to find the means to adjust the contract to encorporate commonality between FOTRS, EOLOROPS and JSIPS.[8]

The TRS currently has two types of ground processing systems, hardened underground facilities and the mobile TRAC system Army corps will collocate with their IPDS and all-source intelligence operations. While USAF would like redundancy in its fixed ground exploitation operation to improve survivability, costs and the increasing difficulty in securing civic approval for US military construction in

Western Europe have made this redundancy very difficult to achieve. In fact USAFE is faced with accepting relatively high risks or looking to smaller mobile systems as backup to TRIGS. Certainly those TRAC units deployed in Europe will offer some backup potential, but TRAC is tailored to Army operations and are few in number. Assuming affordability, it would be more attractive to modify USAF JSIPS to accept TRS-produced ASARS-2 data. This would provide USAFE needed redundancy to the fixed ground facilities and give the USAF a mobile processing capability enabling TRS operations outside of central Europe.

Since the Air Force TRS ground facilities (TRIGS) will house a considerable number of electronic and imagery intelligence personnel, robust data bases and excellent communications, it seems logical these too should be modified to exploit Joint STARS and FOTRS data.

The philosophy for developing the ground processor for Joint STARS has stressed large numbers, small size and low cost. The Army wants them distributed to relatively low echelons of command where photo interpreters will not be available. While the GSM does not lend itself technically to modifications for receipt or FOTRS and TRS data, it is being designed to accommodate some other Army radar-based sensors and as such will provide the commander added utility.

CHAPTER V

SCENARIOS FOR FUTURE INTEGRATION

Figure 1 summarizes where we are with the three key systems. While our disparate baseline programs show no linkage between the three, I've shown above that we have a number of opportunities to take advantage of modern technology (like digitalization and flexible software) and leadership proponency (as displayed by AFSC) to integrate the programs in a meaningful way.

But what can this integration really accomplish? To help answer the question let me describe scenarios (figure 2) where such integration seems to make sense.

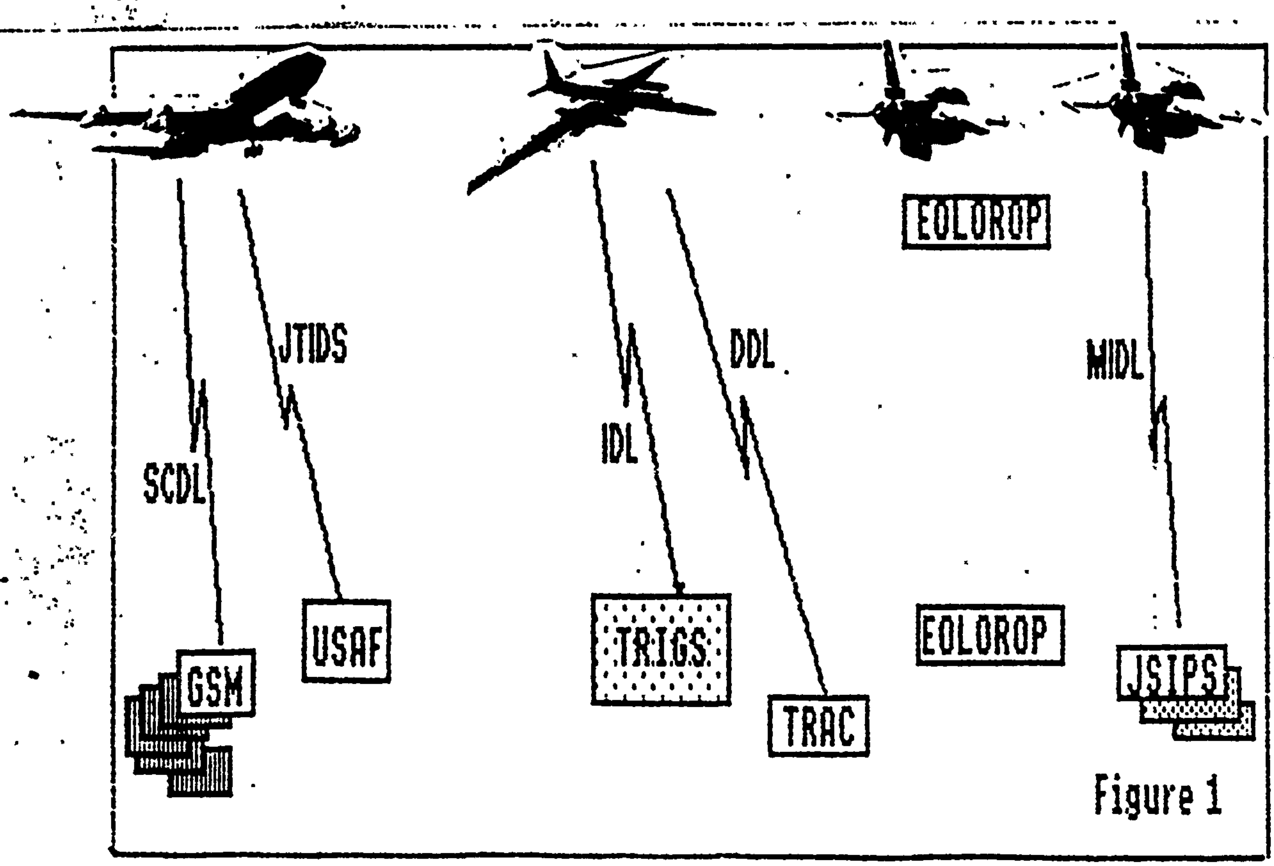

Figure 1

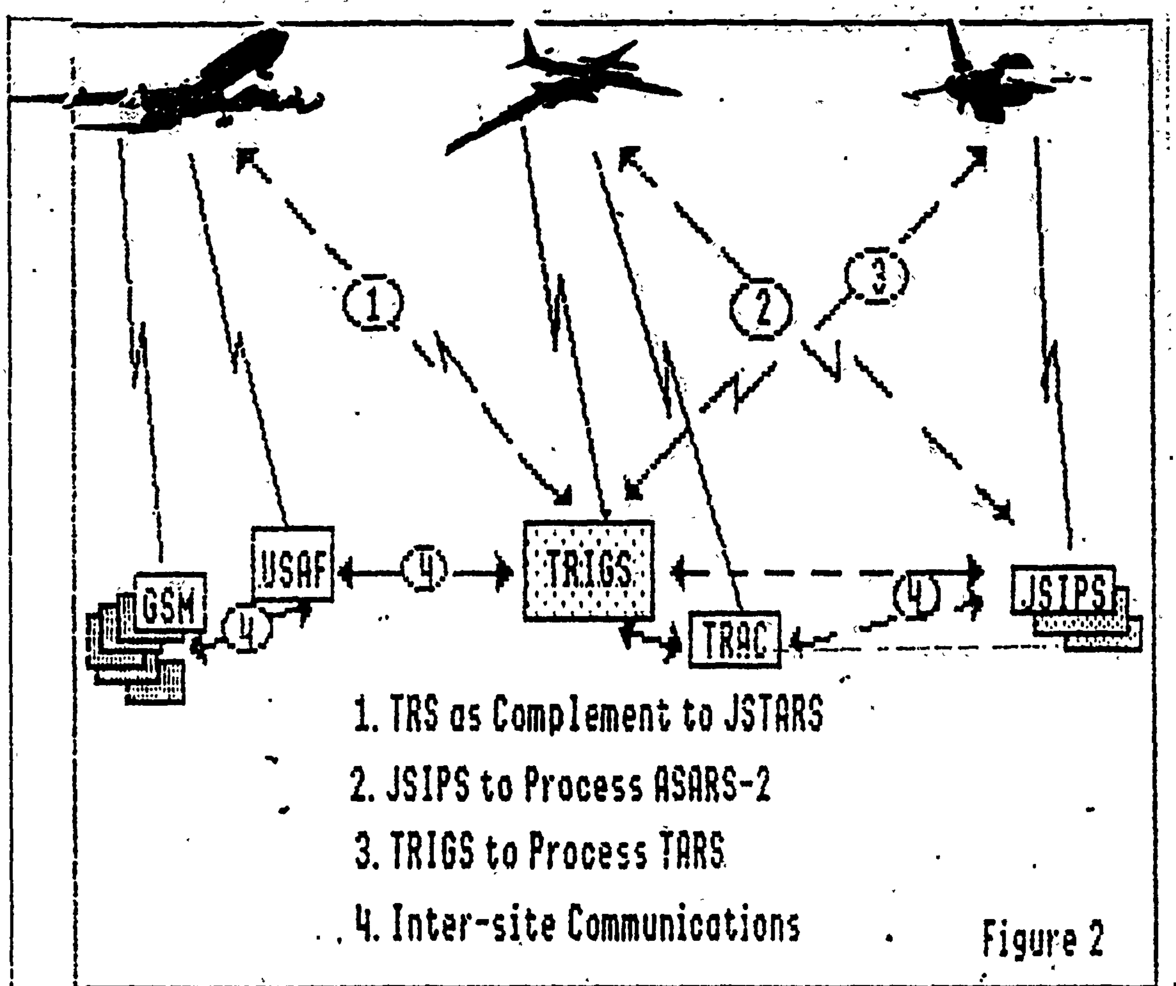

Figure 2

TRS as Complement to Joint STARS

The first scenario takes advantage of the synergism expected in integrating the products of TRS and Joint STARS. TRS with its multisensor capability is excellent at identifying targets in its field of view, while Joint STARS is optimized for tracking large numbers of moving targets and reporting results directly to units able to put fire on the enemy. To maximize the advantages of both, the systems should be modified to permit linking Joint STARS data to the TRS ground site where it will be processed and exploited alongside ASARS-2 and other sensor inputs available at TRS. TRS exploitation personnel, based on their multisensor view of the battlefield, will add amplifying information on the

Joint STARS information and send it back up the two-way SCDL link into the E-8B. In the aircraft operators will flag Joint STARS data with the TRS-produced information and forward it over the SCDL and JTIDS links to the various Army and Air Force users. Information will be constantly updated by both TRS and Joint STARS nodes; in the process they will coordinate and adjust collection and exploitation to ensure priority requirements are thoroughly satisfied.

In the past the intelligence community has been criticized for delaying movement of information while it is held for confirmation or fusion at intelligence centers. In no way would intelligence personnel in TRS delay movement of Joint STARS data. Joint STARS data would continue to flow whether TRS was integrated or not. But integration would result in a number of improvements. First, intelligence personnel at both places will have a complete view of the enemy picture. The resulting reporting to all supported commands, whether over the TRS net or Joint STARS, will be more accurate, enabling commanders to better understand which targets should be attacked and when. Second, the TRS will be able to disseminate much of its information using Joint STARS' very quick and direct communications path to combat units.

JSIPS to Process ASARS-2

The second scenario is intended to improve TRS mobility as well as survivability of TRS processing and reporting operations. Because of its dependence on few hardened fixed facilities, TRS is limited in mobility and survivability. The JSIPS system, to be deployed with select USAF reconnaissance squadrons, has the basic components necessary to accomplish the TRS imagery mission. JSIPS should be made fully capable of exploiting ASARS-2 data, amplifying that data with the benefit of resolutions achievable with low altitude EO sensors, interfacing with TRS imagery interpretors and reporting on assigned targets based on fused imagery information.

While there is unique equipment at the hardened site for mission planning and control of the TR-1 imagery mission which would have to be replicated, not all JSIPS need to be fitted with this feature. Some could simply monitor the ASARS-2 data link and exploit imagery available within their field of view. A select few would be equipped with the mission planning features and be available to take control of the mission if the hardened site were destroyed, or if the TR-1 were to be used outside the line-of-sight tether of the hardened site.

The ASARS-2 enhancement for JSIPS would likely eliminate the need for a separate TRAC system to support Army corps. It would add additional survivability for the TRS and likely improve the product disseminated by JSIPS personnel. It might also enhance the attractiveness of JSIPS as the standard for NATO ground processing. Assuming

ASARS-2 data were releasable to partner nations, the added benefit of being able to monitor TRS collection in NRT would make JSIPS an extremely valuable asset for the NATO commander.

Perhaps more important, with the threat of Warsaw Pact aggression on the decline, an ASARS-2 configured JSIPS would provide the USAF a capability to deploy the TR-1 on contingency operations, as to Oman to cover Silkworm missiles near the Strait of Hormuz. In order to get the full benefit of the three systems in such a scenario, either an Army of Air Force entity could collocate JSIPS (or TRAC) with a GSM, task sensors and exploit and disseminate reconnaissance information in a coordinated and interleaved fashion from a single location.

TRIGS to Process TARS

The third scenario seeks to take advantage of the hardened ASARS-2 exploitation sites to process TARS-type data. With the decline in tactical reconnaissance squadrons, JSIPS ground processors will be relatively few in number. It seems logical to modify those fixed facilities in Europe and Korea designed for ASARS-2 exploitation to receive data downlinked from TARS. These facilties would be available to back up JSIPS sites if JSIPS were unable to receive or report on their targets. In addition, the information available from the RF-X or the UAV, penetrating into areas beyond the vision of either the TRS or Joint

STARS, could cue the standoff systems about activity coming into their area.

Inter-site Communications

While the above recommendations help integrate the reconnaissance team through data links, a more flexible around-the-clock communications system tying the reconnaissance and operations apparatus together is required for successful wartime interface. The European Air Command and Control Improvements Program recognized in 1982 the need for an immediate reconnaissance reporting system for the various tactical reconnaissance systems being used in Europe. However, its recommended solutions were not very comprehensive nor satisfactory. US European Command has been making headway with a Secret-level system called LOCE (Linked Operations-Intelligence Centers Europe) which is currently tying USAF sites like TREDS and the RF-4 squadron at Zweibruecken, West Germany via secure links with numerous NATO operational commands throughout central Europe. Imagery reports can be sent instantaneously over the net dramatically increasing the timeliness of intelligence products. Theoretically, Joint STARS-produced graphic information could also be disseminated over LOCE. LOCE, however, relies heavily on landlines. To serve the highly mobile GSMs, along with the numerous fixed-location NATO headquarters in Europe, it must be more tactically oriented.

The Joint Tactical Fusion Program Office, responsible for LOCE and the Army's premier intelligence fusion program called ASAS (All-Source Analysis System), is developing a tactical terminal for both programs which will deploy with maneuver units in Europe and elsewhere. Both TRS and FOTRS will need to incorporate those communications for worldwide application.

While LOCE today is giving us the type of fusion system and supporting communications needed for integration of FOTRS, TRS and Joint STARS, it is also serving as one of several prototypes for a more ambitious NATO program called BICES (Battlefield Information Collection and Exploitation System). BICES is envisioned as an integrated system of various national intelligence production and fusion systems which will give commanders results of intelligence produced by any of the subscriber countries.[2]

CHAPTER VI

CONCLUSION

The USAF's current tactical reconnaissance assets are far from adequate, but as we've seen there are a number of very capable US and foreign systems being fielded or under development which will have dramatic impact on our future capability. Integrating these systms, even to the relatively limited extent suggested in the scenarios, can have significant payback in terms of survivability, deployability and quality of information for the various associated systems. Adjustment to the program will have costs; we need to weigh these as we proceed with any integration planning.

Some progress has already been made in integrating system components. Certainly the USAF in general recognizes the advantages of integrating various systems. In its Avionics Roadmap published in December 1988 it calls for development of common standard systems, increasing use of joint programs, "consideration of foreign equipment and requirements" and fielding "a family of standard modules."[1] Time and again we've heard lip service paid to interoperability and integration, but without aggressive leadership forcing adherance to its meaning, and sustained funding to actually make it happen, none will be achieved.

The Avionics Roadmap's guidelines make especially good sense in view of the fitful and disparate evolution of tactical reconnaissance over the years and a few programs like FOTRS have done a fair job adopting them within their relatively narrow confines. However, integration of major joint and service programs suffers from lack of service advocacy and interservice rivalry. Integration calls for coordinating concepts and architectures among MAJCOMS and unified commands and identifying program resources among various MAJCOMS and services. As a result it goes beyond the interests of a particular service or program. Interservice working groups have been used for such coordination, but the history of reconnaissance tells us even with these groups vigorous proponency and direction must come from a higher level, preferably within OSD. Accordingly, I recommend OSD/C3I chair a steering group of cognizant JCS and service reconnaissance experts, and include the Defense Acquisition Executive and Service Program Execu-ives Officers responsible for C3I.

In addition I would hope that an understanding of the value of integrating FOTRS, TRS and Joint STARS would encourage planning and programming adjustments at various headquarters (e.g. Air Staff, TAC, EUCOM, CENTCOM, USAFE) so the full benefits of these and related systems can be realized. With a total investment of some $15 billion expected for the three, it would seem a modest additional investment or perhaps reprogramming current investment could bring significant enhancements for the battlefield commanders. Certainly Marshal Ogarkov would expect us to do as much.

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GLOSSARY

AFLC	Air Force Logistics Command
AFSC	Air Force Systems Command
ASARS	Advanced Synthetic Aperture Râdar System
ASAS	All-Source Analysis System
ASTOR	Area Standoff Radar
ATARS	Advanced Tactical Air Reconnaissance System
AWACS	Airborne Warning and Control System
BGPHES	Battle Group Passive Horizon Extension System
BICES	Battlefield Information Collection and Exploitation Ststem
C3I	Command, Control, Communications, and Intelligence
DARPA	Defense Advanced Resarch Projects Agency
EO	Electro-Optical
EOLOROP	Electro-Optical Long-Range Oblique Photography
EUCOM	European Command
FLOT	Foward Line of Own Troops
FOFA	Follow-On Forces Attack
FOTRS	Follow-On Tactical Reconnaissance System
FTI	Fixed Target Indicator
GSM	Ground Station Module
IDL	Interoperable Data Link
IOC	Initial Operational Capability
IPDS	Imagery Processing and Dissemination System
IR	Infrared
JCS	Joint Chiefs of Staff
Joint STARS	Joint Surveillance Target Attack Radar System
JTIDS	Joint Tactical Information Distribution System
JSIPS	Joint Service Imagery Processing System
LOCE	Linked Operations-Intelligence Centers Europe
LOROP	Long-Range Oblique Photography

MAJCOM	Major Command
MIDL	Miniaturized Interoperable Data Link
MTI	Moving Target Indicator
NATO	North Atlantic Treaty Organization
NRT	Near-Real-Time
OPLAN	Operations Plan
ORCHIDEE	Observatoire Radar Coherent Heliporte D'Investigation des Elements Ennemis
OSD	Office of the Secretary of Defense
PACAF	Pacific Air Forces
PMD	Program Management Directive
RAF	Royal Air Force (base)
SAR	Synthetic Aperture Radar
SCDL	Surveillance and Control Data Link
SLIR	Side-looking Infrared System
SON	Statement of Need
SORAO	Sottosistema per la Sorveglianza e Acquisizione Obiettzi
SOSTAS	Standoff Surveillance and Target Acquisition System
SOTAS	Standoff Target Acquisition System
TAC	Tactical Air Command
TAF	Tactical Air Forces
TARPS	Tactical Air Reconnaissance Pod System
TARS	Tactical Air Reconnaissance System
TENCAP	Tactical Exploitation of National Capabilities
TRAC	Tactical Radar ASARS Correlator
TREDS	Tactical Reconnaissance Exploitation Demonstration System
TRIGS	TR-1 Ground Station
TRS	Tactical Reconnaissance System
UAV	Unmanned Aerial Vehicle
USAF	United States Air Force
USAFE	United States Air Forces in Europe